Littoral Antisubmarine Warfare Future Naval Capability (LASW FNC)

Overview Brief

Littoral ASW

Goal: Provide effective capability to detect, track, classify and neutralize subsurface systems including submarines, UUVs, ASW mining, surveillance systems and systems to foul waters/deny access, in support of power projection ashore

Requirements

CAPT J. Ferguson,

CNO (N74), (N702C)

Acquisition

RADM J. Butler,

NAVSEA 93

Execution

Dr. D. Johnson,

ONR 32ASW

Resources

Mr. J. Barkley,

CNO (N911E1)

Fleet/Forces

RDML K. Donald, CPF N6/N8

CAPT J. Carr, CLF N8

ASW Technology Program

- **ASW is a Key Navy Core Competency**
- **Dramatically Restructured S & T**
  - Result of Work Begun in 1997 (ASW Assessment)
    - Series of Analyses and Assessments
    - Warfighter Perspective (Fleet Participation)
- **An Integrated Plan**
- **Core effort to CNO N7's USW Mission Capability Package (MCP) process**
  - Factoring in results of CNO N7's Summer ASW Technology Review Panels

LASW FNC Enabling Capabilities
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- **EC 1 Tactical Sensing: Effectively detect, classify, localize, and track USW targets to support engagement outside the threat weapons release range. EC1 is comprised of three components:**
  - la Active Sensing: Increase gain to XX dB against clutter/false contact
  - 1b Passive Sensing: Increase passive gain by YY dB
  - 1c Non-acoustic Sensing: Achieve non-acoustic search rate of ZZ nmi2 equivalent per hour
- **EC 2 Characterize the Battlespace: Significantly improve ASW performance through accurate and timely understanding of the battlespace**
  - Leverage "Through the Sensor" in-situ measurements
  - Improve common model in-situ measurements and environmental databases enabling tactically useful planning and performance assessments

- **EC 3 Wide Area Surveillance: Rapidly and/or covertly deploy and sustain surveillance system for wide area search, detection, and cueing. Primary goal to develop affordable technologies that provide sustainable ability against the high-end diesel threat**
  - Decrease total Life Cycle Cost to xx% of current Advanced Deployable System (ADS)
  - Deploy by surface ship, aircraft, or submarine
  - Deploy to 90% of AORs in yy days
  - Deploy in zz nmi2 field or xx nmi barrier in one day
  - Provide Pd > .yy and FAR < . zz within 12 hours
  - Provide system design life options from xx days to yy years
- **EC 4 Neutralization: Effectively engage/neutralize bottomed, surfaced, or low-doppler targets beyond threat weapon release range**
  - Increase Pk to > .xx for heavyweight torpedoes
  - Increase Pk to > .xx for lightweight torpedoes
  - Decrease Pck

EC-1 Tactical Sensing

Product Line: Active Sonar

- **Multistatic ASW**
Develops two low frequency active sources, multistatic signal processing algorithms, performance prediction models, and upgrades an existing volumetric receiver. Provides an effective multistatic detection/ classification/localization capability using offboard sensors designed to be deployed from a variety of platforms.

- **Light Weight Search System (LWSS)**
Develops a lightweight impulsive sound source and associated signal processing for use by helicopters and other platforms.

- **Environmentally Adaptive SQQ-89 (EA SQQ-89)**
Develops a mode of operation for the SQQ-89 sonar that allows it to sense changes to the acoustic environment and automatically self-optimize through active sonar adaptive processing and adaptive sonar control. Provides for improved performance of the AN/SQQ-89 active sonar in littoral areas, where significant and rapid change to the acoustic environment limits sonar performance.

- **Lightweight Broadband Variable Depth Sonar (LBVDS)**
Develops a capability to transmit broadband signals below the acoustic layer, improving active sonar performance in challenging acoustic environments such as the littoral regions where high levels of reverberation and mixed multi-path propagation effects dominate. The demonstration system will utilize the Multi-Function Towed Array (MFTA) as its receiver.

- **Littoral Warfare Advanced Development (LWAD)**
Robustly tests and demonstrates LASW FNC technologies using fleet assets and testing in forward areas underpinning meaningful analysis of warfighting payoff. Collection of in-water data fundamentally supports technical developments.

- **HF Broadband Transducers & Arrays for Submarines**
Develops an improved performance broadband transmitting and receiving array with the capability of performing collision avoidance and ASW functions. This effort is targeted for implementation as a high-frequency flank array on the sail of SSN 688I submarines.

EC-1 Tactical Sensing (Continued)

<u>**Product Line: Passive Sonar**</u>

- **Sonar Automation**

  Develops new algorithms enhancing sonar automation by providing the capability to reliably extract and associate acoustic signature components from threat targets, improve clutter rejection, improve initial detection and holding times, and increase initial detection range.

- **Robust Passive Sonar**

  Determines fundamental limits of passive sonar in the littorals. Develops a test bed facility composed of a set of fixed sonar sensor arrays and signal processing equipment for evaluating new algorithms and future array concepts that exploit the space-time properties of acoustic propagation in a high shipping and ambient noise level shallow water environment.

- **Counter-Torpedo Detection, Classification and Localization**

  Develops signal processing algorithms and acoustic sensor improvements providing robust cueing for soft- and hard-kill countermeasure systems, including the WSQ-11() Tripwire/Anti-Torpedo Torpedo.

<u>**Product Line: Non-Acoustics**</u>

- **Claymore Marine**

  Develops an optical airborne ASW algorithm/sensor that enhances airborne search rates, increases probability of detection, and improves clutter rejection providing an improved capability to detect threat submarines operating in the littorals.

- **Affordable Radar Periscope Detection and Discrimination (ARPDD)**

  Develops a hardware/software implementation of recently developed and successfully demonstrated detection and discrimination algorithms that will dramatically reduce system development, acquisition and maintenance costs. This is an affordability initiative that will exploit advances in computational power anticipated in the out-years.

Littoral ASW FNC Products

EC-2 Characterize the Battlespace

- **Common Tactical Picture (CTP)**
  Improves ASW tactical detection performance through cross-platform sensor-level fusion.
- **Advanced Estimation of Sensor Performance (Common Environmental Picture (CEP) and CT/EP Uncertainty)**
  Improves organic sensor performance estimates and improves organic and cross-platform target tracking by sharing of sensor performance estimates. Applies estimates of sensor performance uncertainty to improve tactical decision aids.

EC-3 Wide Area Surveillance

- **Deployable Shallow Water Autonomous System**
  Develops a rapidly deployable autonomous distributed underwater sensor field composed of acoustic and electromagnetic sensors networked without physical links that can transmit information ashore without cables.

EC-4 Neutralization

- **Weapon/Platform Connectivity**
  Develops broadband active signal processing, torpedo intelligent controller algorithms, and submarine tactical picture content for dramatically improved torpedo Probability of Kill (Pk).
- **Non-Traditional Homing**
  Develops an alternative torpedo sensor that enables target homing with reduced counter-detectability.

LASW FNC Timelines and Transition Points

Product Lines		02	03	04	05	06	07

EC 1
Tactical Sensing

Active Sonar

Products:
• Lightweight Broadband Variable Depth Sonar (LBVDS)
• Environmentally Adaptive SSQ-89 (EA-89)
• Counter-Torpedo D/C/L (CTDCL)

- 03: • LBVDS • EA-89
- 04: • EA-89
- 05: • CTDCL
- 06: • CTDCL
- 07: • CTDCL
- 03: •DD (X) •AN/SQQ-89 A (V15)
- 04: •AN/SQQ-89 A (V15)
- 05: • APB •AN/SQQ-89 A (V15)
- 06: •AN/SQQ-89 A (V15)
- 07: • APB

Active Sonar

Product:
• HF Broadband Array For Submarines

- 05: • High Frequency Broadband Array
- 05: • HFFA

Active Sonar

Products:
• Multistatic Active
• Lightweight Search System (LWSS)

- 02: • Multistatic
- 03: • Multistatic
- 04: • Multistatic
- 05: • Multistatic • LWSS
- 06: • Multistatic
- 07: • Multistatic
- 02: •APB
- 03: •APB
- 04: •APB
- 05: •Adv. Sub. Systems (Source) •APB •SH(60)R
- 06: •ACES (Compact Receiver)
- 07: •ACES (Compact Source)

Passive Sonar

Products:
• Sonar Automation (SA)
• Robust Passive Sonar (RPS)

- 02: • SA
- 03: • SA
- 04: • SA
- 05: •SA •RPS
- 06: • SA • RPS
- 07: • SA • RPS / • SA • RPS
- 02: • APB
- 03: • APB
- 04: • APB
- 05: • APB
- 06: • APB
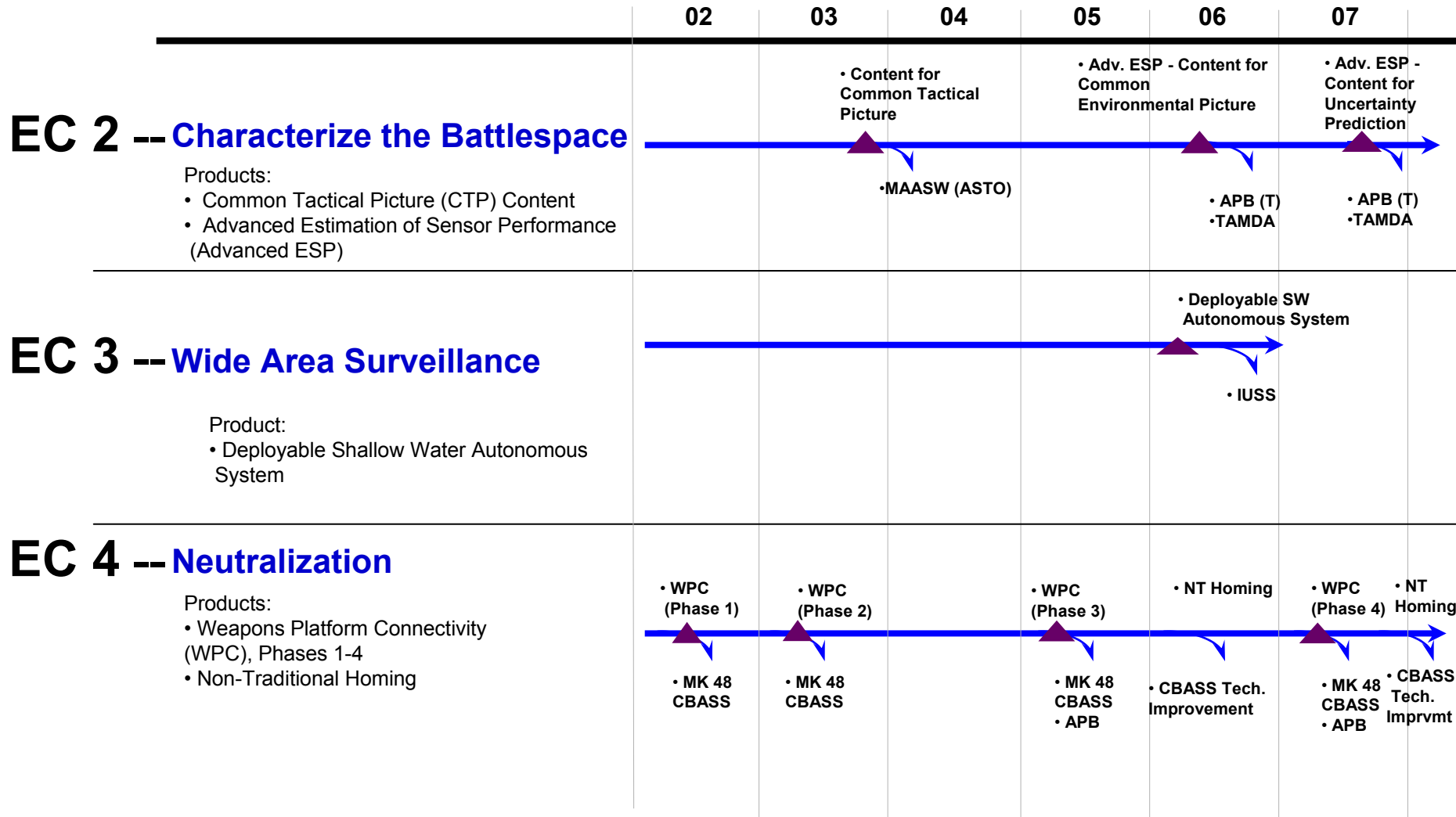- 07: • APB / • APB •Multiline Towed Array

Non-Acoustic

Products:
• Claymore Marine
• Affordable Radar Periscope Detection And Discrimination (ARPDD)

- 05: •Claymore Marine
- 07: • ARPDD
- 05: • Air Systems
- 07: • Air Systems
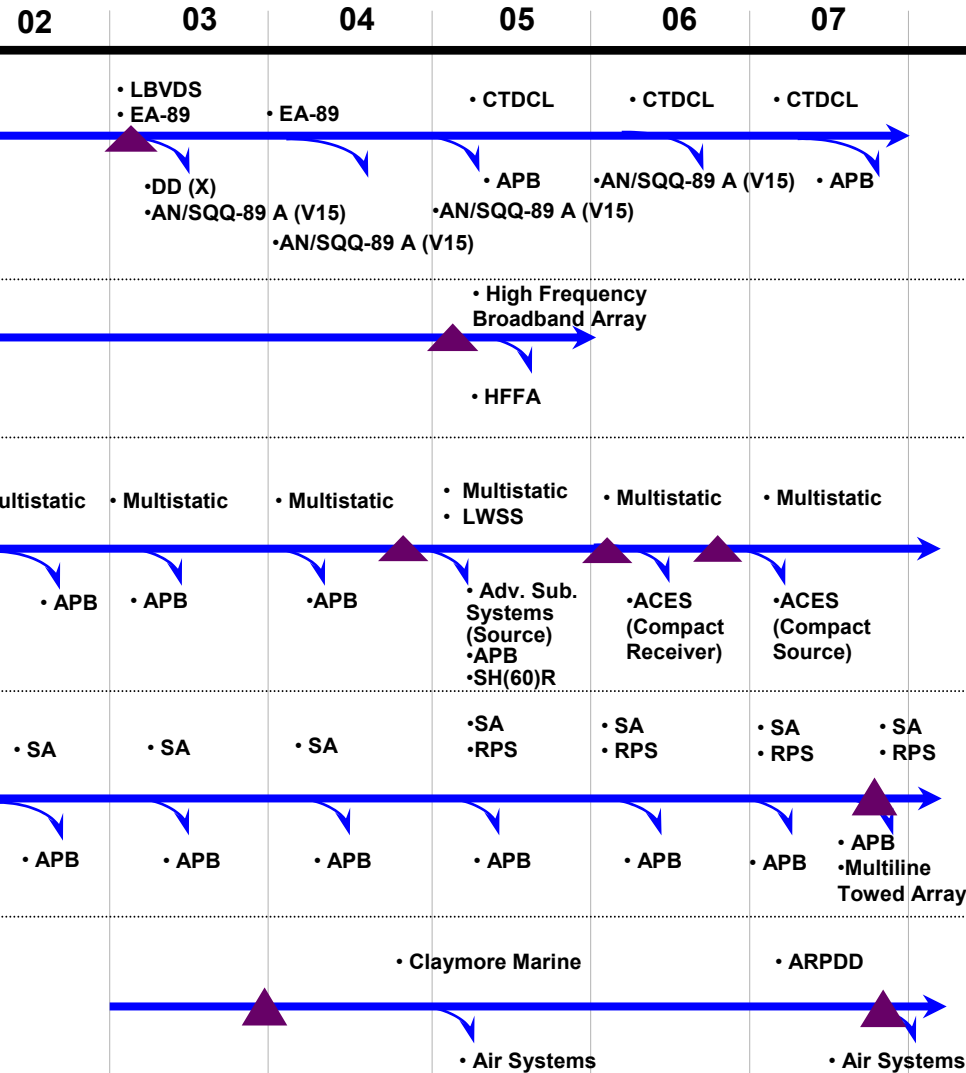
▲ **Indicates Demo – Not IOC**

LASW FNC Timelines and Transition Points

	02	03	04	05	06	07

EC 2 -- **Characterize the Battlespace**

- • Content for Common Tactical Picture (at 03)
- • Adv. ESP - Content for Common Environmental Picture (at 05)
- • Adv. ESP - Content for Uncertainty Prediction (at 07)

▲ (03) •MAASW (ASTO)

▲ (06) • APB (T) •TAMDA

▲ (07) • APB (T) •TAMDA

Products:
- • Common Tactical Picture (CTP) Content
- • Advanced Estimation of Sensor Performance (Advanced ESP)

EC 3 -- **Wide Area Surveillance**

- • Deployable SW Autonomous System (at 06)

▲ (06) • IUSS

Product:
- • Deployable Shallow Water Autonomous System

EC 4 -- **Neutralization**

- • WPC (Phase 1) (02)
- • WPC (Phase 2) (03)
- • WPC (Phase 3) (05)
- • NT Homing (06)
- • WPC (Phase 4) (07)
- • NT Homing (07)

▲ (02) • MK 48 CBASS

▲ (03) • MK 48 CBASS

▲ (05) • MK 48 CBASS • APB

(06) • CBASS Tech. Improvement

▲ (07) • MK 48 CBASS • APB

• CBASS Tech. Imprvmt

Products:
- • Weapons Platform Connectivity (WPC), Phases 1-4
- • Non-Traditional Homing

▲ **Indicates Demo – Not IOC**

Littoral ASW FNC Transition Status

Product	Acquisition Program	Acquisition Manager	TTA/MOA/Ltr	Transition Status
Lightweight Broadband Variable Depth Sonar (LBVDS) FY 03	IUSW-21 for the DD-21	PMS-500	Being re-negotiated in light of DD-21 cancellation	🟢
Environmentally Adaptive AN/SQQ-89 FY 03 and FY 04	AN/SQQ-89(V)15 and AN/SQQ-89A(V)15 P.E. 0205620N	PMS-411	MOA Signed 15 June 01	🟢
Multistatic Active – Signal Processing FY 02, FY 03 and FY 04	Submarine Combat Systems Improvements (APB/A-RCI) P.E. 0603561N	SEA-93 ASTO	Signed Transition Commitment 5 February 02	🟢
Sonar Automation FY 02, FY 03, and FY04	Submarine Combat Systems Improvements (APB/A-RCI) P.E. 0603561N	SEA-93 ASTO	Signed Transition Commitment 5 February 02	🟢
Common Tactical Picture FY 04	Multistatic Active ASW (MAASW) P.E. 0603553N	SEA-93 ASTO	Signed Transition Commitment 5 February 02	🟢
Weapons Platform Connectivity – FY 02 and FY 03	MK48 Common Broadband Advanced Sonar System (CBASS) P.E. 0205632N	PMS-404	Signed Transition Commitment 7 February 02	🟢

Elements of Tactical Acoustic Sensor Performance Estimation